

**Assessment Schedule – 2010****Statistics and Modelling: Calculate confidence intervals for population parameters (90642)****Evidence Statement**

| Q          | Evidence   | Code    | Judgment  | Sufficiency   |
|------------|--|---------|---|---|
| ONE<br>(a) | $4.7 \pm 3.28201$<br><b>OR</b><br>$1.418 < \mu_1 - \mu_2 < 7.9819$<br>Accept: $1.4g < \mu_1 - \mu_2 < 8.0$<br>$4.7 \pm 3.3$  | a       | Accept any rounding more than one sig. fig.<br>Accept intervals written in equivalent forms.<br>(Not left = right =).<br>CAO. Ignore units.   | <b>Achievement:</b><br>1 a                                    |
| (b)        | As the interval is entirely positive, there is very likely to be a difference in the effectiveness of the fertilisers. Fertiliser A is very likely to be more effective in producing heavier tomatoes than Fertiliser B.<br>Must have interval correct from 1(a).  | m       | Or equivalent.<br>Zero is not included in the interval and Fertiliser A > Fertiliser B sample mean then...<br>Must refer to the positive aspect of the difference and thus the effectiveness of Fertiliser A. | <b>Merit:</b><br>1 a plus 1 m                                 |
| (c)(i)     | $3.3 \pm 3.26895$<br><b>OR</b><br>$0.031102 < \mu_1 - \mu_2 < 6.5688$<br>Accept: $0.031 < \mu_1 - \mu_2 < 6.6$<br>$3.3 \pm 3.3$  | a       | Accept any rounding more than one sig. fig.<br>Accept intervals written in equivalent forms.<br>(Not left = right =).<br>CAO. Ignore units.   |   |
| (ii)       | The change in sample size has little effect on the width of the confidence interval as $\sigma_2^2/25$ or by $\sigma_2^2/30$ has a negligible difference.<br>The actual differences in the limits of the interval are due to the nature of confidence intervals in that, whilst in the long run, 95% of sample difference between the means will be enclosed within the confidence interval, it is very likely that different pairs of samples will produce different intervals.<br>Must have interval correct from 1(a) <b>AND</b> 1(c)(i). | m       | Must have a comment about: <ul style="list-style-type: none"> <li>the sample sizes and</li> <li>the nature of confidence intervals.</li> </ul> OR equivalent statement(s).                                    |   |
| (d)        | Let $T$ = total weight of 6 tomatoes.<br>$E(T) = 811.2$<br>$SD(T) = 14.207$<br>$95\% \text{ CI} = 811.2 \pm 1.96 \times 14.207$<br>$= 811.2 \pm 27.832$<br>$783.4 < \mu < 839.0$<br>Accept: $780 < \mu < 840$  | e → (a) | Need to show correct $E(T)$ and $SD(T)$ .<br>Accept any rounding more than one sig. fig.<br>Accept intervals written in equivalent forms.<br>(Not left = right =).<br>Ignore units.                           | <b>Excellence:</b><br>1 e, 1 m plus 1 a<br>OR<br>1 e plus 2 m |

| Q          | Evidence  | Code   | Judgment  | Sufficiency                                |
|------------|---|--|---|--|
| TWO<br>(a) | $0.51 \pm 0.058145$<br>OR<br>$0.45185 < \pi < 0.56814$<br>Accept: $0.45 < \mu < 0.57$<br>$0.51 \pm 0.06$  | a  | Accept any rounding more than one sig. fig.<br>Accept intervals written in equivalent forms.<br>(Not left = right =).<br>Ignore units.<br>CAO.  | <b>Achievement:</b><br>1 a                 |
| (b)        | For $p = 0.5$ :<br>$n > 1067.1$<br>$n = 1068$<br>1068 should be surveyed.<br>(accept 1070 but not 1060)<br><br>For $p = 0.51$ :<br>$n > 1066.8$<br>$n = 1067$<br>1067 should be surveyed.<br>(accept 1070 but not 1060)   | m  | Must be rounded up.<br>Accept if they have used 0.51 as the proportion.<br>Do not accept at least, minimum, ..., $n <$ , $n \leq$ , $n >$ or $n \geq$ .<br><br>Watch the rounding here:<br>Eg:<br>$\begin{array}{r} 0.25 \\ \hline 0.000234 \end{array} \checkmark$ $\begin{array}{r} 0.25 \\ \hline 0.00023 \end{array}$ $\begin{array}{r} 0.25 \\ \hline 0.00023 \end{array}$ Do not accept: $n = 1100$             | <b>Merit:</b><br><br>1m plus 1 a           |
| (c)        | $0.26 \pm 0.05102$<br>$0.20898 < \pi < 0.31102$<br>Accept: $0.21 < \pi < 0.31$<br>$0.26 \pm 0.05$<br><br>The change in the value of $\pi$ affects the standard error the more it varies from 0.5.<br>For 0.5 as an estimate of $\pi$ , if the sample proportion is unknown, this is a worst case scenario that maximises the standard error.<br>For maximum value of $p(1 - p) = 0.25$ , occurs when $p = 0.5$<br>Must have interval correct. | (a)<br><br><br><br><br><br><br><br><br><br><br>e $\rightarrow$ (m) | Accept any rounding more than one sig. fig.<br>Accept intervals written in equivalent forms.<br>(Not left = right =).<br>Ignore units.<br>CAO.<br><br>Must have interval correct to get e (m).<br>The new interval does have a different standard error, 0.031, compared with the previous error of 0.0353.<br><br>Must have comment about the effect proportion has on the std error.<br>OR equivalent statement(s). | <b>Excellence:</b><br><br>1e, 1 m plus 1 a |

**Judgement Statement**

| Achievement   | Achievement with Merit                                | Achievement with Excellence   |
|---|---|---|
| Calculate confidence intervals for population parameters. | Demonstrate an understanding of confidence intervals. | Demonstrate an understanding of the theory behind confidence intervals. |
| <b>2 A</b>  | <b>1 M + 1 A</b>                                      | <b>1 E + 1 M</b>  |

The following Mathematics-specific marking conventions may also have been used when marking this paper:

- Errors are circled.
- Omissions are indicated by a caret (^).
- **NS** may have been used when there was not sufficient evidence to award a grade.
- **CON** may have been used to indicate 'consistency' where an answer is obtained using a prior, but incorrect answer and **NC** if the answer is not consistent with wrong working.
- **CAO** is used when the 'correct answer only' is given and the assessment schedule indicates that more evidence was required.
- **#** may have been used when a correct answer is obtained but then further (unnecessary) working results in an incorrect final answer being offered.
- **RAWW** indicates 'right answer, wrong working'.
- **R** for 'rounding error' and **PR** for 'premature rounding' resulting in a significant round-off error in the answer (if the question required evidence for rounding).
- **U** for incorrect or omitted units (if the question required evidence for units).
- **MEI** may have been used to indicate where a minor error has been made and ignored.